Food and Agriculture Organization of the United Nations

The International Treaty ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Item 15.4 of the Provisional Agenda

EIGHTH SESSION OF THE GOVERNING BODY

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Reports from Institutions that have Concluded Agreements with the Governing Body under Article 15 of the International Treaty

Executive summary

This addendum contains the Report by the Government of Ivory Coast in regard to the International Coconut Genebank for African and the Indian Ocean under Article 15 of the International Treaty. The Report is provided in the form and language it was received.
Additional information concerning maintenance of the Genebank can be found in document, IT/GB-8/19/15.4/2.

Guidance Sought

The Governing Body is invited to consider this additional report and provide further guidance, taking into account the elements for a possible Resolution as provided in Appendix 1 of document, IT/GB-8/19/15.4/2.

Biennial Report on the ITPGRFA Article 15 Status of the International Coconut Genebank for Africa and the Indian Ocean

BY

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Introduction

The Marc Delorme Station, Port Bouet, Côte d' Ivoire hosts the International Coconut Genebank for Africa and the Indian Ocean (ICG-AIO) of 126 accessions (including 11 unique accessions). It is curated by the *Centre Nationale de la Recherche Agronomique* (CNRA). The genebank's site has been sold for urban development, posing a serious threat to the collection and linked trials, so options to safeguard these have been explored. The Ivorian government has the primary responsibility to safeguard the collection. When the ICG was established, the Ivorian Government, FAO and Bioversity (as the then host to COGENT) signed a tripartite agreement, subject to the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). Under Article 15 of the Treaty, the three parties are obliged to take measures within their power to safeguard the collection.

In June 2018, Côte d'Ivoire's Primature commissioned CIRAD to conduct a mission for a preliminary assessment of the options for transferring the collection to another site. In October 2018, the CIRAD team reported the collection's reasonable phytosanitary condition, and diminished agronomic status, and proposed options for securing and transferring the collection. As a follow-up, in April and June 2019, the Ivorian Primature commissioned CIRAD (who involved also ITPGRFA and COGENT), to conduct a more detailed feasibility study for transferring the collection and present the findings of the study. These missions where implemented with collaboration with CNRA coconut experts.

The main conclusions of the CIRAD missions are as follows:

1. Safeguarding the international collection housed in the Marc Delorme station is the primary objective of the expert mission. This conservation can take several forms: duplication of genebank into another site in Côte d'Ivoire, frozen and preserved pollen, zygotic embryos collected and preserved *in vitro* or cryopreserved, with back-up in Côte d'Ivoire and/or in another country. Back-to-back CNRA recommend to fence the Station and relocate land buyers to another site.
2. The team of experts has established that the CNRA station at Divo is the preferred site for the transfer of the international collection and strategic trials
3. The main option chosen by CNRA is a duplication of the most important accessions of the collection at various other sites in Côte d' Ivoire and possibly outside the country. A first stage concept note has already been submitted to the UK Darwin Initiative, bidding for funds to support this duplication (module 4 below)
4. A strategy has been defined for the transfer of the entire collection by constituting working modules which can be independent:
    i. Module 1: transfer to Divo of the 31 most important accessions
    ii. Module 2: duplication of module 1 on other sites in Côte d'Ivoire (6 sites)
    iii. Module 3: cryopreservation of pollen from the 31 unique and important accessions of the collection

iv. Module 4: Embryo collection for these 31 accessions, in vitro storage, cryopreservation and embryo transfer outside Côte d'Ivoire or partially into the Central Biotechnology lab of CNRA
v. Module 5: Divo preservation in the field of a balanced sampling of diversity (8 accessions in addition to 31)
vi. Module 6: Preserving the entire collection at Divo (60 accessions in all)
vii. Module 7: Transferring unconventional genetic resources to Divo
viii. Module 8: Creating Seed nurseries at Divo
ix. Module9: Creating multiplication sites at Divo
x. Module 10: Monitoring Lethal yellowing Disease at both Marc Delorme Station and Divo including supervising of eventual disease spreading in the country.

5. The area corresponding to all these modules have been estimated: the safeguarding of 31 accessions in Divo represents only the planting of 15 ha in the field, while the rescue of all genetic resources in total will require a planted area of 72.3 ha. All of the essential areas in Divo, with the land resources and the areas for the renewal of the collection will require to a total area at Divo of 350 ha. If it considers all kind of facilities (labs, office, accommodations…) it will need 500 ha which is available.
6. All the technical and financial aspects of these different modules have been evaluated. A chronogram has been produced, with annual budgets for each of the modules and general operations related to the transfer. Estimates of the cost of transfer run into many millions of US dollars. The Ivorian Government will need the support of the international community to mobilise much of these resources to support this transfer and rescue the collection.
7. Special attention has also been paid by experts to the control of the coconut lethal yellowing disease (LYD), a disease that threatens coconut plantations worldwide, and is present in the region of Grand Lahou, Côte d'Ivoire. Proposals for a disease control strategy, with related budgets, have been offered by the experts.
8. A precise schedule of fertilization, controlled pollination, nut-harvesting and plot release operations is proposed by the experts over a total of 13 years, including a first year of "rehabilitating" the plots at the Marc Delorme station.

Status of the collection

Following the 2018 and 2019 CIRAD feasibility study for transferring the collection, table 1 presents details of the existing accessions and their status

Table 1 List of designated Germplasm and planted in ICG-AIO at Marc Delorme Station, Port Bouet, Côte d'Ivoire and their status

#	Local Name & code		International Name & code		Type	Plot & Planting date		status
ICG 01	Grand des Indes Andaman Géant	GND 3	Andaman Giant Tall	AGT	TALL	62	2009-2011	Threatened
ICG 02	Grand Indes Andaman Ordinary	GND 2	Andaman Ordinary Tall	ADO T	TALL	62	2009-2011	3 coll. or more
ICG 03	Grand Bay-Bay	GBB	Baybay Tall	BAY T	TALL	142	1982	2 coll.
ICG 04	Grand Cambodge Battambang	GCB 9	Cambodia Tall Battambang	KAT0 9	TALL	91	1988-1989	Unique
ICG 05	Grand Cambodge Koh Rong	GCB 10	Cambodia Tall Koh Rong	KAT1 0	TALL	91	1988-1989	Unique
ICG 06	Grand Cambodge Ream	GCB 7	Cambodia Tall Ream	KAT0 7	TALL	91	1988-1989	Unique
ICG 07	Grand Cambodge Sre Cham	GCB 8	Cambodia Tall Sre Cham	KAT0 8	TALL	91	1988-1989	Unique
ICG 08	Grand Cambodge Tuk Sap	GCB 2	Cambodia Tall Tuk Sap	KAT0 2	TALL	72	2009-2011	Threatened
ICG 09	Grand Cameroun Kribi	GCA	Cameroon Kribi Tall	CKT	TALL	62	2009-2011	Unique
ICG 10	Nain Rouge Cameroun	NRC	Cameroon Red Dwarf	CRD	DWARF	42	2008-2011	3 coll. or more
ICG 11	Nain Vert Philippines Catigan	NVP 2	Catigan Green Dwarf	CATD	DWARF	42	2008-2011	2 coll.
ICG 12	Grand Comores Moheli	GCO	Comoro Moheli Tall	CMT	TALL	111	1972	Unique
						72	2009-2011	Duplicate
ICG 13	*Nain Vert Guinée Equatoriale*	*NVE*						*Synonyme de NVB*
ICG 13	Nain Vert Brésil	NVB	Brazilian Green Dwarf	BGD	DWARF	42	2008-2011	2 coll.

#	Local Name & code		International Name & code		Type	Plot & Planting date		status
ICG 14	Grand Gazelle	GNG 4	Gazelle Peninsula Tall	GPT	TALL	63	2007-2011	3 coll. or more
ICG 15	Grand Kappadam	GND 5	Kappadam Tall	KPD T	TALL	62	2009-2011	Threatened
ICG 16	Grand Kar-Kar	GNG 1	Karkar Tall	KKT	TALL	62	2009-2011	3 coll. or more
						102	1975	Duplicate
ICG 17	Nain Vert Philip. Kinabalan	NVP 6	Kinabalan Green Dwarf	KIND	DWA RF	142	1982	Threatened
ICG 18	Grand Laccadive Micro	GND 7	Laccadive Micro Tall	LMT	TALL	62	2009-2011	Threatened
ICG 19	Grand Laccadive Ordinaire	GND 8	Laccadive Ordinary Tall	LCT	TALL	62	2009-2011	2 coll.
ICG 20	Nain Brun Nouvelle Guinée	NBN	Madang Brown Dwarf	MBD	DWA RF	92	1979	3 coll. or more
ICG 21	Nain Vert Malaisie	NVM	Malayan Green Dwarf	MGD	DWA RF	142	1983	2 coll.
ICG 22	Nain Rouge Malaisie	NRM	Malayan Red Dwarf	MRD	DWA RF	42	2008-2011	3 coll. or more
ICG 23	Grand Malaisie	GML	Malayan Tall	MLT	TALL	M63	1981-1983	3 coll. or more
						72	2009-2011	Duplicate
ICG 24	*Nain Jaune Ghana*	*NJG*						*Synonyme de NJM*
ICG 24	Nain Jaune Malaisie	NJM	Malayan Yellow Dwarf	MYD	DWA RF	42	2008-2011	3 coll. or more
ICG 25	Grand Markham Valley	GNG 3 GMV	Markham Valley Tall	MVT	TALL	142	1984	3 coll. or more
ICG 26	Grand Mozambique	GMZ	Mozambique Tall	MZT	TALL	72	2009-2011	Unique
ICG 27	Nain Niu Leka	NNL	Niu Leka Dwarf	NLA D	DWA RF	42	2008-2011	3 coll. or more
ICG 28	Grand Indonésie Palu	GDO 3	Palu Tall	PUT	TALL	72	2009-2011	Threatened
ICG 29	Nain Vert Philippines Pilipog	NVP 5	Pilipog Green Dwarf	PILD	DWA RF	42	2008-2011	2 coll.
ICG 30	Grand Polynésie Rangiroa	GPY 2	Rangiroa Tall	RGT	TALL	72	2009-2011	3 coll. or more
ICG 31	Grand Rennell	GRL	Rennell Island Tall	RIT	TALL	91	1988-1989	3 coll. or more
ICG 32	Grand Rotuma	GRT	Rotuman Tall	RTM T	TALL	81	2002	3 coll. or more
ICG 33	Grand Salomon	GSN	Solomon Island Tall	SIT	TALL	63	2007-2011	2 coll.

#	Local Name & code		International Name & code		Type	Plot & Planting date		status
ICG 34	Nain Vert Sri Lanka	NVS; SGD!	Sri Lanka Green Dwarf	PGD	DWARF	42	2008-2011	3 coll. or more
ICG 35	Grand Sri Lanka Amélioré	GSL	Sri Lanka Tall Ambakelle	SLT02	TALL	81	2002	2 coll.
ICG 36	Nain Vert Philippines Tacunan	NVP3	Tacunan Green Dwarf	TACD	DWARF	92	1980-1982	Threatened
ICG 37	Grand Tagnanan	GTN	Tagnanan Tall	TAGT	TALL	81	2002	2 coll.
						102	1974	Duplicate
ICG 38	Nain Rouge Tahiti	NRY	Tahitian Red Dwarf	TRD	DWARF	92	1978	Unique
ICG 39	Grand Polynésie Tahiti	GPY1	Tahitian Tall	TAT	TALL	62	2009-2011	2 coll.
ICG 40	Grand Indonésie Takome	GDO1	Takome Tall	TKT	TALL	72	2009-2011	Threatened
ICG 41	Grand Indonésie Tenga	GDO2	Tenga Tall	TGT	TALL	72	2009-2011	2 coll.
ICG 42	Nain Brun Indonésie	NBO	Ternate Brown Dwarf	TBD	DWARF	132	1985	Unique
ICG 43	Nain Vert Thaïlande	NVT	Thailand Green Dwarf	THD	DWARF	115	1995	Threatened
						92	1972	Duplicate
ICG 44	Grand Thaïlande Ko Samui	GTH4	Thailand Tall Ko Samui	THT04	TALL	91	1988-1989	Threatened
ICG 45	Grand Thaïlande Sawi	GTH1	Thailand Tall Sawi	THT01	TALL	63	2007-2011	Threatened
ICG 46	Grand Tonga	GTG	Tonga Tall	TONT	TALL	81	2002	3 coll. or more
ICG 47	Grand Ouest Africain Akabo	GOA3	West African Tall Akabo	WAT03	TALL	62	2009-2011	Unique
ICG 48	Grand Ouest Africain Mensah	GOA4	West African Tall Mensah	WAT04	TALL	62	2009-2011	Unique
ICG 49	Grand Ouest Africain Ouidah	GOA6	West African Tall Ouidah	WAT06	TALL	63	2007-2011	Threatened
ICGS 50	Nain Vert Aromatique	NVP7	Aromatic Green Dwarf	AROD	DWARF	92	1995	3 coll. or more
ICGS 51	Grand Cambodge Kopal" Tani"	GCB4	Cambodia Tall Kopal Tani	KAT04	TALL	72	2009-2011	Unique
ICGS 52	Grand Feu" Kompong Trach"	GCB5	Cambodia Tall Kompong Trach	KAT05	TALL	63	2007-2011	Unique

#	Local Name & code		International Name & code		Type	Plot & Planting date		status
ICGS 53	Nain Vert Cambodge Kolke	NVC	Cambodian Green Dwarf	KGD	DWARF	111	1970	Unique
ICGS 54	Grand Vanuatu	GVT	Vanuatu Tall	VTT	TALL	81	2002	3 coll. or more
ICGS 55	Grand Cambodge Ktis Battambang	GCB 11	Cambodia Tall Ktis Battambang	KAT1 1	TALL	43	1995	Unique
ICGS 56	Grand Cambodge Kampot	GCB 3	Cambodia Tall Kampot	KAT0 3	TALL	72	2009-2011	Unique
ICGS 57	Grand Panama Aguadulce	GPA 1	Panama Tall Aguadulce	PNT0 1	TALL	63	2007-2011	2 coll.
ICGS 58	Grand Panama Monagre	GPA 2	Panama Tall Monagre	PNT0 2	TALL	63	2007-2011	2 coll.
59	Agta Tall	AGAT	Agta Tall	AGAT	TALL	office	2014	coll
60	Bago-Oshiro Tall	BAOT	Bago-Oshiro Tall	BAOT	TALL	office	2014	coll

Status of acquisitions, regenerations, duplications and distributions

Table 1 provides a good snapshot of the ICG-AIO accessions status.

Regarding acquisitions, regenerations, duplications and distributions, since 2012, several types of material including pollen, seednuts, seedlings, nuts, and embryos have provided to many countries for research and/or development purposes (Ghana, Sierra Leone, Nigeria, Mozambique, Germany, Cameroon, and Sri Lanka). Between 1980 and 2017, of the 135 officially recorded accessions provisions from coconut collections, 64 (47%) have originated from the ICG-AIO, indicating it has been most active in sharing germplasm, albeit at a rather low level.

Providing resources can be mobilised (see below), the Ivorian Host Government, supported by the efforts of COGENT and the ITPGRFA, will ensure the final collection will be re-established in Divo as the new principle ICG-AIO site.

Lethal Yellowing Disease, (LYD) is widespread and occurring in a number of provinces outside of Abidjan, (see the accompanying feasibility report from CIRAD) but establishing the new collection in Divo should help mitigate the risk of LYD incursion. Tests indicate that there is no LYD incidence in the current collection and also into Divo new indicated site.

Donor support and benefit-sharing

In conjunction with COGENT and its new host the International Coconut Community (ICC), CNRA has applied for funding from the UK Darwin Initiative, to duplicate and cryopreserve accessions. However, the proposal has not been endorsed for second stage development.

COGENT has just been informed that it will be receiving two years of funding from ACIAR to support its revitalisation. This will help COGENT to support the ICG-AIO with its resource mobilisation efforts. With a stronger presence, it is hoped that a revitalised COGENT will also better support ICG-AIO activities, including capacity building, conservation and benefit-sharing. This will begin on January 1, 2020.

Local donor FIRCA (inter-professional funds for research and agriculture advice) is currently giving some support to follow trials of selecting LYD tolerant/resistant cultivars in the department of Grand Lahou.

Ongoing research projects

In addition to conservation, the Marc Delorme Station of CNRA is undertaking three modules of work to enrich coconut genetic diversity and maintain seednut production and multiplication activities and secure the genebank. We have established with the help of Bioversity International, Cirad and the CGIAR some mapping populations that are contributing to genomic studies.

Module 1: Non-conventional genetic resources

The genetic trials of the station contain a considerable genetic diversity, as first- or second-generation crosses between Dwarfs and Talls, or incorporating genetically interesting traits. In the offspring of these crosses, one may expect to find new genotypes that may eventually produce new remarkable varieties.

Among these, we can note:

1. Transgressive genotypes, significantly superior to both parents, combining the favourable alleles of genetically distant parents,
2. Resistance or tolerance to lethal-yellowing disease, associated with late germination (meeting a need in West Africa),
3. The combination of the slow growth of the Dwarf-types with the higher productivity of the Tall-types
4. The improvement of the Dwarf-types, with greater diversity, and for some an accentuation of dwarfism.
5. Resistance or tolerant coconut to drought associated with high yielding (project in building with Imperial College London, England.

Given the great diversity of this non-fixed material, the use of markers (genomic selection, Genome-wide association studies - GWAS) is almost inevitable. The recent sequencing of the coconut genome is a valuable asset.

This material is not part of the collection, although it is nonetheless a valuable resource of threatened genetics. Indeed, in coconut a generation represents between 7 and 9 years. In other words, if a representation of this genetic material is not preserved, it cannot be reconstituted for a further twenty years or more. This material can be grouped under six categories:

Category	Nature	Trees	density	Surface (acres)
E1	Disjunction between Large of distant origins	500	143	3.50
E2	F2 Dwarf x Tall	550	160	3.44
E3	F3 Dwarf x Tall	200	160	1.25
E4	New Dwarfs	200	205	0.98
E5	Super Dwarfs (autogamous Dwarfs x Niu Leka)	150	205	0.73
E6	Back-cross 1 (genotyped by GBS)	600	160	3.76
Grand total		1900		13.87

The use of open pollination minimizes the cost of seeds and the time required for implementation of the program.

Module 2: Seednut nurseries

CNRA is keen to create replicate its seednut nurseries in any new site. They will be prepared by controlled hand pollination. They will have to be separated from the collection (in the northern part of the station or into another station of CNRA). They will consist of four parcels of Dwarfs (NJM, NRM, NRC and NVB). These plots should be surrounded and separated by a forest screen.

Module 3: Multiplication plots

Propagation plots are used to provide pollen for improved seednut production. Seeds produced with elite parents produce about 25% more than any first-generation hybrid. We are aiming that CNRA maintains its ability to produce elite seed-nuts that contribute to improving the productivity of Ivoirian coconut plantations or worldwide level, and provide financial resources to CNRA.

Other ICG-SP needs

It is important that CNRA builds capacity in tissue culture, molecular diagnostic facilities including a dedicated laboratory, equipment and capacity building programme (on breeding- including controlled hand pollination, tissue culture and cryopreservation). Any support from ITPGRFA, FAO would be most welcome in this regard or other donor. The collection needs to develop a sustainable business model to ensure that income generating activities can help to support the genebank maintenance going forwards.